DEPARTMENT OF HEALTH SERVICES
DRINKING WATER FIELD OPERATIONS BRANCH
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Baldwin Park Operable Unit Steering Committee
c/o Donald E. Vanderkar
Aerojet General Corporation
P. O. Box 13222
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Dear Mr. Vanderkar:

COMMENTS ON THE OCTOBER 29, 1998 DRAFT PHASE 2 TREATABILITY STUDY WORK PLAN, PILOT SCALE GROUNDWATER TREATMENT SYSTEM (BALDWIN PARK OPERABLE UNIT, SAN GABRIEL BASIN)

This is to acknowledge that the Department has received the October 29, 1998 Draft Phase 2 Treatability Work Plan (Work Plan) prepared by Harding Lawson Associates (HLA) for the Baldwin Park Operable Unit Steering Committee on December 4, 1998. Also on January 19, 1999, we received HLA's letter dated January 13, 1999, in response to the Department's comments on the May 20, 1998 Draft Phase 2 Work Plan. The following is the Department's response as a result of a review of both documents:

The Work Plan accomplishes the task of outlining the objectives of the Phase 2 study. However, the Work Plan is not and should not be used as a study protocol. A study protocol outlines, in details, the means by which objectives in the Work Plan will be addressed. For example, a study protocol would detail the analytical tests to be conducted, the frequency of sampling, quality assurance and quality control protocols to assure data integrity and literature review. None of these elements are present in the Work Plan. Although the Work Plan is sufficient to outline the objectives of the study, the Department does not consider the Work Plan sufficient to make an evaluation of how its earlier comments will be addressed. Sufficient data both in quality and quantity are needed to provide the degree of confidence that the performance observed in the trials would be representative of actual field performance. Unless the questions raised in our comments are addressed by demonstration, the Department will not approve the proposed treatment process.

The following are the Department's comments on the October draft of the Work Plan.

1. **Page 1-2: "Operation of the Phase 1 system identified operating parameters that can be used to achieve optimum system performance and established operating limits for these parameters."**

   Page 3-5: "ORP data collected during Phase 1 indicated that an ORP of less than approximately –250 millivolts (mV) corresponded..."

   While there was some indication that it might be feasible to control the system with certain operating parameters, the work conducted under Phase 1 was not sufficient to establish these parameters as appropriate operating parameters nor was there sufficient

work conducted to establish the operating limits. The Department does not consider the work completed to date to be an adequate demonstration of these operating parameters.

Any demonstration of an operating parameter needs to include an actual demonstration of process failure (to operate in a mode that would create failure conditions with subsequent study to examine the recovery of the system).

Oxygen Reduction Potential (ORP) in the Phase 2 study should be monitored by an on-line instrument equipped with data acquisition capability and sufficient storage capacity for data collection.

2. **Page 3-2 to 3-3: "The proposed mechanism... then to hypochlorite (OCL^-)..."**

The hypothesized mechanism for perchlorate destruction raises an interesting question. If this mechanism is correct, will there be, at some point in the operation of the reactor, sufficient hypochlorite (disinfectant) generation that will create a toxic environment, at a micro-scale, to the microorganisms present?

3. **Page 3-3: "Biological contact time and ethanol requirements will both increase..."**

The discussion regarding perchlorate destruction up to this point only discusses the reaction stoichiometry from an empirical perspective. The discussion does not refer to the reaction kinetics, which are important in the design and sizing of the biological reactors. The importance of biological contact time is noted in this statement, but it is not clear why the contact time will increase with the higher dissolved oxygen concentration. Please expand this discussion.

It would also increase the confidence in the treatment process, if the Department could be assured by demonstration, that perchlorate destruction was not just a consequence of nitrate reduction. That is, we would like to know if the perchlorate destruction is due to its conformational similarity to nitrate, and since the enzyme systems for reduction of nitrate are setup, the perchlorate is reduced concomitantly with the nitrate simply because it looks structurally similar to nitrate to the enzyme system. A portion of this question may be answered during the Phase 2 study. By examining operational parameters such as the food to microorganism ratio and nutrient concentrations (as suggested by the proposed reaction stoichiometry, nitrate also serves as nitrogen source for biosynthesis), we may be able to determine the impact of nitrate concentrations on the overall performance of this biological process.

4. **Page 3-4 to 3-5: "Optimum ethanol dosage was determined to be approximately 40 mg/L for...This concentration is approximately 43 percent higher than predicted by the empirical ethanol requirement equation..."**

The Department concurs that additional work will be required to optimize the ethanol dosage. However, the study should not be limited to only examining complete perchlorate and nitrate destruction. The study should also examine the impact of changing process conditions and water quality conditions on the unit process finished water. The effluent water quality conditions must be examined during and following any process parameter change and must be continued until the process reaches steady-

state condition again. The study should use a five mean cell residence time as a rule of thumb to allow the process to reach to steady-state condition. Other values may be used if it can be demonstrated that steady-state conditions are met sooner.

5. **Page 4-4: "... the biological inoculum used to seed the growth of biomass will be characterized using plate count..."**

Standard bacterial plate counts will not be sufficient to identify human pathogens. Virus sample collection and analysis should be conducted on the inoculum. This should include enteric virus and bacteriophage enumeration. The variation of microorganism composition with time in the inoculum (the seed) and in the reactor (biomass) should be investigated. The frequency and number of samples should be based on the frequency of occurrence in the inoculum. The number of samples collected should be sufficient to ensure with 95% confidence that a difference of 10% could judge to be significant. The frequency of sampling should not be less than one-third the period of the shortest cycle so that sampling will be sufficient to characterize the shortest occurrence cycle. The protocol for the inoculum characterization should include standard bacteriological techniques to identify (to genus and species level) bacteria present in the reactor. Enteric viruses should also be typed.

6. **Page 5-3: UV/Oxidation**

This technology has not yet been approved for use as a mean of NDMA treatment. This technology needs to demonstrate the destruction or removal of NDMA. There are anecdotal reports that NDMA has been found in systems after UV/Oxidation and that it is unclear why and how the NDMA got through the UV/Oxidation process. Was the process incomplete in its destruction of NDMA (or NDMA precursors) allowing NDMA to reform in the distribution system? This remains an unknown that needs to be explored.

7. **Page 5-4: "The Phase 2 Pilot System will include disinfection for a small portion (5 gpm) of the total flow to establish chlorine dose and required contact time...The study will include quantification of chlorine dose, chlorine contact time, CT_{10} calculation, chlorine residual..."**

Page 6-7: "Optimum chlorine dose will be determined during pilot testing based on residual chlorine concentration."

To a certain extent, the project is to demonstrate the efficacy of using biological treatment for the destruction of perchlorate. The optimum disinfectant concentrations could be based on the CT requirements or on the microbial water quality. The study must provide the Department with sufficient information on which of these parameters will control the inactivation.

Note that a long pipe arranged in a serpentine fashion is proposed as a chlorine contact unit. For pipelines, it is usually assumed that all fluid passing through the pipe have a detention time equal to the theoretical residence time at a given flow rate. However, the proposed process diagram shows that the proposed sodium hypochlorite injection point is located in the pipeline prior to the contact unit without any mixing device. Given the small amount of flow to be studied, the chlorine feed pump must provide continuous and

uniform feed stream so that the above assumption could be valid. Pulsing feed pumps should be avoided. Otherwise, the chlorine contact unit should be checked by tracer study to determine their true t_{10} values at given flows. In addition, the feasibility to provide for chloramination should be considered.

8. **Page 6-2: Operating parameters such as...MLSS will also be monitored and biological growth parameters such as mean cell residence time (sludge age), specific utilization rate, specific growth rate, and F/M ratio will be evaluated.**

In view of the attached growth nature of the GAC/FB bioreactor, the Department is interested in knowing where the sampling locations for MLSS measurement will be and how the mean cell residence time and F/M ratio will be evaluated. Does a plan to evaluate the specific utilization and growth rates exist?

9. **Page 6-2 to 6-3: Ethanol and phosphate amendments**

It appears that the feed rates of ethanol and phosphoric acid will be based on and controlled by the levels of the ORP in the reactor. If the feed rates are controlled by an ORP prop or any other device, a complete evaluation of the operation and maintenance (calibration requirements, calibration frequency, etc.) of the device, to ensure continuous and reliable operation, should be completed. In addition, the lag time between the dosage adjustment to the actual change in ORP level should be evaluated.

10. **Section 6.4 Multimedia Filters**

To optimize filters performance, on–line particle monitors should be installed on the individual filters and the filter influent prior to polymer addition.

In addition, since the filter will be operated in biological mode, backwashing procedures should be optimized to ensure the maintenance of established microbial population subsequent to backwash events. Backwash turbidimeters should be installed for use on the individual filters to monitor solids release during backwash. Data acquisition and a storage device should be provided. The turbidity measurements should be verified by TSS, Total Coliform and HPC samples during selected backwash cycles to determine optimal conditions.

11. **Page 6-5: "Filter effluent for the first 10 minutes of each filter run will be discharged to the reclamation system holding tank for treatment in the reclamation system. Optimum filter-to-waste time will be determined during pilot testing based on measurement of filter effluent turbidity following backwash."**

This paragraph seems to contradict itself. The period of filter-to-waste should be based on turbidity readings, not time.

12. **Table 6-1 Preliminary Pilot System Design Criteria**

- Recycle pump design criteria are missing in the GAC/FB Bioreactor Section.

- The sludge yield factor of 0.8 VSS/$NO3^-$ as N is a typical value of cell yield, Y, for the denitrification process as documented in literature. This factor is important for biomass control operation and the design of reclamation/solid handling system, therefore, should be verified. The Department recommends that sludge yield factor based on COD removed be evaluated.

- No data was provided for the biomass control system.

- In-line static mixer information is missing under Multimedia Filters Section.

- It appears that the flows from the reclaimed water recovery system were not accounted for in the sizing of the filters. The filters appear to be designed for 250 gpm each. Therefore, the hydraulic loading of the filter will exceed the target upper testing range of 8 gpm/ft^2 when one of the filters is off-line during backwash.

With regard to the HLA's letter dated January 13, 1999, the response to the question raised on item number 3 is insufficient. It is the Department's view that testing for indicator organisms alone is inadequate for the identification of human pathogens. It is our understanding that the project team includes individuals with expertise in microbiology and significant experience with biological systems. These individuals should be consulted for what kinds of tests are necessary for the purpose of this project. At a minimum, the presence of regulated microorganisms and microorganisms listed in the EPA's Drinking Water Contaminant Candidate List should be investigated.

If you have any questions, please contact me at (213) 580-5748.

Sincerely,

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